Denali Commission Award 1478
New Stuyahok to Ekwok Intertie Construction
Final Closeout Summary Report June, 2018

This Closeout Summary Report is filed with the federal grantor agency the Denali Commission ("Denali" or "DC") by the grantee partner Alaska Village Electric Cooperative, Inc. ("AVEC"). The federal grant award covered by this report and this project is 01478-00 ("1478"), as subsequently amended once. AVEC was the grantee of DC funding and other funding for this project and is the sole project participant. As owner and operator of the new electric transmission intertie, AVEC is also responsible for future maintenance.

This project is being closed because the project is complete and is in full operation, and the funding has expired. This report represents the project status as of March 31, 2018. As of that date, total project costs exceeds total project funding by $40,025; AVEC paid these excess costs and no federal funds are available for deobligation.

Background – AVEC is a member-owned, non-profit electric utility serving members in 58 communities throughout rural Alaska. Only one of these communities is on the state's road system; most are accessible by water (though only one in the winter); and all are accessible by scheduled air service year-round.

This project benefits the remote rural communities of New Stuyahok, Alaska (population 507) and Ekwok, Alaska (population 113). New Stuyahok is organized as a second class city under Alaska law, and is located on the Nushagak River about 12 miles upriver from Ekwok and 52 miles northeast of Dillingham. It lies at approximately 59.452780 North Latitude and -157.311940 West Longitude. (Sec. 29, T008S, R047W, Seward Meridian.) Ekwok is also organized as a second class city, and lies at approximately 59.3497 North Latitude and -157.4767 West Longitude. (Sec. 35, T009S, R049W, Seward Meridian.)

Both communities are located in the Bristol Bay Recording District and Dillingham Census Area, in an area characterized by tundra interspersed with boreal forest. They fall within the transitional climate zone; the primary influence is maritime, although a continental climate also affects the weather; this produces long, cold winters and shorter, warm summers. Average summer temperatures (in Fahrenheit) range from 37 to 66; winter temperatures average 4 to 30. Annual precipitation ranges from 20 to 35 inches. Fog and low clouds are common during the summer; extremely strong winds often preclude access during the winter. The Nushagak River is generally ice-free only from June through mid-November.

Activities - The scope for this project involved the final design and construction of a 7.9-mile-long, 12.47 kV electric power transmission line between New Stuyahok and Ekwok, electrical connections to the power grids of each community, and conversion of the Ekwok power plant to standby generation only. As a standby backup power plant (SBPP), the converted Ekwok generation facility will power Ekwok when power is not available over the intertie for any reason.

The route of the intertie runs through undeveloped, non-flood-prone land consisting of dry upland tundra (5.4 miles) and brushy or forested terrain (2.5 miles); it's generally flat or gently rolling except one section about ¼ mile long crosses one major ravine about 100 feet deep on each side. The intertie was built within rights-of-way granted by the owners of the land the intertie route traverses, namely the two local ANCSA village corporations, Stuyahok Ltd. and Ekwok Natives Ltd.

Two prior efforts, both funded by the Denali Commission, addressed aspects of this intertie. First, the potential for the intertie between New Stuyahok and Ekwok was initially evaluated in the comprehensive feasibility study of a number of potential AVEC interties funded by DC award 356-07 (DC project 73A); that initial overview study concluded that the New Stuyahok – Ekwok intertie was feasible (i.e., bore a positive benefit-cost ratio). Second, DC project 44D performed a cursory map study and recommended a specific route for this specific intertie; further information is available in the DC project 44D Closeout Summary Report.

This project was developed and built as part of an amalgamated program which included the intertie as well as other energy projects. In New Stuyahok, three bulk fuel storage tank farms were built (one for AVEC's power plant, one for the community, and one for the school) under DC award 1190 during 2011-2012; additional fuel storage capacity was included in the AVEC tank farm to accommodate the addition of Ekwok's demand to the New Stuyahok power generation system. The existing New Stuyahok prime power plant was relocated using AVEC funds only; this power plant has three generators and sufficient capacity to meet the N-1 criteria for both communities (able to meet the combined communities' peak loads even if its largest generator is offline). The new power plant location is adjacent to the new school and this enables a new heat recovery system to optimally gather excess heat off the generators and pipe it to the school where the recovered heat supplies part of the school's space heating needs and displaces heating fuel that would otherwise be consumed. Southwest Region School District installed the new heat recovery system in 2013 – 2016 with funding from the State of Alaska's Renewable Energy Fund.

AVEC has long maintained prioritized rankings of its facilities, with the goal of first upgrading those with the highest environmental risk exposure; and/or those presenting the greatest opportunity for increases in fuel efficiency (measured in kilowatt-hours produced per gallon of fuel, or kWh/gallon), such as through consolidation and interconnection of communities, or replacement of older, less efficient generators and control systems, or incorporation of renewable energy sources, etc. Construction of the New Stuyahok – Ekwok Intertie accomplishes some of these important goals; most notably, it consolidates the two communities' electric loads into one grid powered by one prime power plant in New Stuyahok whose generators can run more regularly and at speeds that optimize fuel efficiency; and elimination of one prime power plant, a direct result of the new intertie, will result in lower long-term overall operations and maintenance costs than the two separate power plants incurred before the intertie. The new intertie also helps to increase the total amount of energy the New Stuyahok heat recovery system can capture by concentrating generation into one power plant, thus in turn concentrating available heat output and allowing one heat recovery system to operate more efficiently than two systems could if operating at lower volumes.

Errico Electrical Engineering LLC ("EEE") designed the intertie under DC project 38D; other important preconstruction activities and contractors are more fully discussed in the 38D Closeout Summary Report. Under the subject award 1427, EEE was engaged to bring that earlier design up to current codes and standards, and to review permits for any necessary renewals. EEE also prepared a portion of the bid documents (design sheets and specifications), and provided construction design assistance throughout the construction phase. AVEC staff created the contract documents. In fall 2013, EEE and AVEC personnel

travelled to the site to perform a site survey and establish intertie routing. EEE delivered the final design to AVEC in late 2013.

United States Department of Agriculture, Rural Utilities Service awarded AVEC a grant in June 2014 to fund the intertie construction itself. The RUS award totaled $2,520,000 and required AVEC matching funds of $280,000; it was fully expended (including match) by April 2016. Meanwhile, the subject award DC 1478 came on line in September 2015 both to complete funding of the intertie construction and to provide funds for the remainder of the scope necessary to make the intertie usable, specifically the conversion of the Ekwok power plant to standby generation only and electrical connections to the power plants and grids of each community.

In May 2015, AVEC engaged contractor STG, Incorporated ("STG") under an existing term contract to construct the intertie; the contract eventually totaled $3.155 million including 2 change orders totaling $237K. Cost savings were pursued and realized due to the fact STG was already mobilized and constructing another public infrastructure project in Ekwok at the time; the intertie budget benefited particularly as regards cost of mobilizing construction machinery and establishing crew quarters.

AVEC directly procured major materials (poles, attachments, conductor). All major materials and construction equipment, which are most cost-effectively shipped by barge, were on-site before the onset of freeze up of the local seas in fall 2015. To avoid damaging fragile tundra, wetlands and permafrost soils in the construction zone, all field work was executed during winter, and only once local soils had frozen to an adequate depth. STG mobilized to the Ekwok end of the intertie route starting in September 2015, then commenced construction in earnest in January 2016 and completed it in April 2016.

The snow cover in the project area was well below historical norms during construction; there was only trace snow cover in January, and by the end of March there was no snow cover to protect the frozen tundra from the potentially long-lasting damaging effects of construction machinery. In order to complete this project within the winter 2015 – 16 construction season a helicopter was employed to stage the materials along the line. This enabled the construction crew to make two passes with the heavy equipment which caused little to no damage to the tundra; construction without the helicopter lifts would have required multiple heavy equipment passes, with consequent extensive and unacceptable level of damage to the tundra surface. AVEC decided this better long term environmental outcome justified the additional cost.

H-pile foundations support 49 of the new poles, and 106 new poles were direct-set without pile foundations. A substantial completion inspection was conducted in April 2016. STG then satisfactorily completed all punch list tasks, AVEC verified and accepted the completed intertie in June.

AVEC field crews executed all scope other than construction of the intertie itself. Materials were procured starting in summer 2016 for conversion of the Ekwok power plant to standby generation and for electrical connections to the power grids at each end of the intertie. Field work in Ekwok was completed by spring 2017, and work in New Stuyahok was completed by fall 2017. Work in New Stuyahok included installation of new switchgear components designed to optimize automated switching and breaking of the intertie and to optimize selection of the most efficient combination of gensets to serve the load at any one time. Following completion of this work in both communities, the intertie was energized on October 4, 2017.

Funding and Costs - Funding to date has been provided by grants to AVEC from the Denali Commission and from the USDA Rural Utilities Service, and matching cash contributions from AVEC, as shown in the following table:

Funding and Costs, Project 1478: New Stuyahok – Ekwok Intertie	Federal portion of award	AVEC matching contributions	Total All Sources
Denali Commission award 1478	$ 790,738	$ 175,000	$ 965,738
USDA – RUS award AK27N84	$ 2,520,000	$ 280,000	$ 2,800,000
Total Funding (Budget)	$ 3,310,738	$ 455,000	$ 3,765,738
Total Actual Costs	$ 3,310,738	$ 495,025	$ 3,805,763
Costs in excess of funding	$ 0	$ 40,025	$ 40,025

$26,076 of the federal portion of DC 1478 was designated solely to, and did in fact, reimburse AVEC's reported indirect costs. Total project costs ($3,805,763) exceeds total funding ($3,765,738) by $ 40,025. These excess costs were paid by AVEC and are considered an additional grantee contribution to the project.

Problems Encountered/Lessons Learned – Constructing several major infrastructure facilities in two nearby communities over an approximately six-year timeframe resulted in better long term designs, reduced cost of installation, and reduced life cycle costs. The measurable success of these projects, including this intertie, was and will continue to be greatly due in part to the cooperation and support of these projects by community stakeholder entities and individuals. Stuyahok Ltd. and Ekwok Natives Ltd. contributed site control without remuneration by granting comprehensive, necessary rights-of-way for the intertie. The contractor STG performed within schedule and budget.

Conclusions - The completed project meets all current regulations and codes governing electrical transmission facilities of this size.

Bibliography:

Coffman Engineers: *Conceptual Design Report and Addendum; Bulk Fuel Storage, Recovered Heat and Power Systems Upgrades, New Stuyahok, Alaska*. Prepared for Alaska Village Electric Cooperative; October 17, 2007.

Alaska Village Electric Cooperative, Inc.: *Electric Intertie Options for Several Rural Alaska Villages, pp. 40 – 44.* Funded by AVEC and Denali Commission; October 2014; attached to Closeout Report for Project 73A, Denali Commission award 356-07.